Prediction of cooperation in orthodontic treatment

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A prospective study of patient cooperation with orthodontic treatment was conducted on 100 adolescent patients. Patient, parent, and orthodontist questionnaires were used at three stages of orthodontic treatment. The first was used at the initiation of treatment and the latter two at 6-month intervals. Psychosocial measures from investigators reported in orthodontic patient cooperation literature were screened for use in the present study. These measures included attitudes toward treatment, social desirability, need for approval, and need for achievement. None of the variables selected for this investigation adequately predicted cooperation of a patient in orthodontic treatment. The stepwise regression procedures indicated that inclusion of all variables accounted for 40% of the variability. Variables assessing the orthodontist's perception of orthodontist-patient relationship had the strongest association with patient compliance. (AM J ORTHOD DENTOFAC ORTHOP 1992;102: 15-21.)

A successful orthodontic treatment depends on a variety of factors. Although the knowledge and skills of the clinician remain significant, the cooperation of patients and that of the parents, in the case of children and adolescent patients, plays a major role in achieving the desired results. Patient cooperation is the single most important factor every orthodontist must contend with. Major considerations are (1) regularity in keeping appointments, (2) compliance in wearing rubber bands and headgear or wearing removable appliances, (3) refraining from chewing hard and tenacious substances that are likely to distort the arch wires and remove bonded brackets, and (4) maintenance of oral hygiene. Laxity in following these instructions may lead not only to compromised treatment but also to slow progress of treatment, loss of chair time, and frustration.

Prediction of patient compliance could be helpful to anticipate problems that might arise during treatment and alleviate them before they impede or interfere with treatment. Possible interventions could range from simple oral hygiene reinforcement and maintenance for a probationary period to suspending treatment until attitudes about the offending aspect of treatment can be changed. In addition, techniques to improve the doctor-patient relationship could be employed. If patient characteristics associated with cooperative treatment behavior could be identified, perhaps efforts could be made to remove barriers with treatment or to defer treatment until treatment readiness has been achieved.

Identifying characteristics that predict cooperation with treatment is a difficult and complex problem. Any number of factors may influence the patient's response to treatment. For example: (1) The interaction between the patient, the patient's environment, and the care-giver; (2) the patient's attitude about the severity of their condition; (3) the patient's beliefs about the efficacy of the treatment to be delivered; (4) the patient's expectations about the success of the treatment; and (5) the patient-doctor relationship.

REVIEW OF LITERATURE

Some authors have suggested that the clinician might be assuming the role of a surrogate parent from whom the adolescent is trying to gain autonomy.1,2 Attempts at using personality variables to predict compliance have not been successful. Allan and Hodgson3 reported a study to predict patient cooperation with the use of standardized measurements of personality. They had 30 subjects, 13 boys and 17 girls, with an age range of 12 to 18 years from middle-class suburban families. Each patient had been receiving treatment for a minimum of 1 year. They found that age was the single best predictor of patient cooperation. The younger patients tended to be more cooperative. Similarly, Weiss4 concluded that 12-year-old and younger patients were more cooperative than older patients. However, even the younger patients were less cooperative in keeping appointments and in protecting appliances from breaking.

Higher socioeconomic groups tend to cooperate more than lower socioeconomic groups. This may be due to differences in values of facial esthetics. For example, higher socioeconomic groups may believe that.

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malocclusion and the associated facial disharmony might have a social influence and could hinder their chances of obtaining jobs, running for public office, or succeeding in their social relationships. However, Dorsey and Korabik found that lower middle class patients considered orthodontic treatment to be more important than the upper middle class patients. Alley thought that regardless of socioeconomic status, facial appearance is probably the most important aspect of physical appearance that determines how others feel about us and how we feel about ourselves.

However, Starnbach and Kaplan studied demographic factors that were associated with cooperative patients. On a sample of 362 patients evaluated retrospectively, they found that female patients from moderate to lower socioeconomic groups were better patients.

Lewit and Virolainen examined behavioral dispositions with severity of the malocclusion on a sample of 15 male patients and 9 female patients with good occlusion, 53 male patients and 42 female patients with moderate malocclusion, and 4 male patients and 6 female patients with severe malocclusion. They concluded that a patient's perception of their own malocclusion was a better predictor of cooperation than that of the orthodontist, and that dependent adolescents regarded their parent's wishes as more important than adolescents with a low dependency on parents but a high need for peer approval who perceived peer standards as the most important. In other words, if their peers valued an esthetically pleasing occlusion, low-dependency adolescents would internalize these values. For the self-reliant adolescents, reality factors predominated. If they perceived they had a malocclusion, they would cooperate with treatment. These patterns were much clearer in upper than lower socioeconomic groups.

Kreit et al. studied patient cooperation from a personality test administered by 120 dentists. They found that the most salient feature of uncooperative patients was the perception of poor relations with their parents. On the other hand, cooperative patients were rather conventional and conforming.

Weiss and Diseren found that for better patient compliance, patient's personality traits were far more important than their education in matters relating to health. It has been suggested that there is variability in perception of need for orthodontic treatment by patients, which depends on factors, such as the patient's social feedback and support group.

Slakter et al. introduced the Orthodontic Patient Cooperation Scale for prediction of cooperation. The scale consisted of a list of 10 patient behaviors. They evaluated 45 adolescent subjects under orthodontic treatment at 2 and 6 months into treatment. They reported that the Orthodontic Patient Cooperation Scale had adequate internal consistency to be used as an instrument to monitor patient cooperation.

El-Mangoury indicated that orthodontic cooperation was predictable through psychologic testing. She devised three psychoorthodontic theories of motivation to provide a conceptual framework for the investigation of orthodontic cooperation: (1) achievement motivation, (2) affiliation motivation, (3) attribution motivation. In this study, the following items were used to determine patient cooperation: (1) headgear wear, (2) elastic wear, (3) appliance maintenance, (4) missed appointments, (5) punctuality in appointments, and (6) oral hygiene. The battery of tests used were time-consuming and did not include the parent's motivation or the priority for treatment and the relationship of the child to their parents.

Research from the Albino group suggests that persons vary greatly in their perceptions of the esthetic effects of dentofacial relations. Consequently, they also vary in their perceptions of the need for orthodontic treatment. The objective of their study was to develop a reliable self-report technique for assessing the attitudes toward malocclusion and the desire for orthodontic treatment. This resulted in the development of the Orthodontic Attitude Survey. It was a combination of the Desire for Orthodontic Treatment by Lewit and Virolainen and the Critical Incident Technique by Linn. The Orthodontic Attitude Survey included a wide spectrum of questions investigating many different attitudes toward malocclusion. There were separate forms for the parents and the child.

Their results indicated that, while there were many facets included in the decision to seek orthodontic treatment, there were two important sections that reflected the desire for orthodontic treatment: (1) the wish for treatment by the child and the parent, and (2) the concern about dental occlusion by the child and the parent. The section of the Orthodontic Attitude Survey patterned after the Critical Incident Technique by Linn was found to have potential for discriminating among children who have differing levels of desire for orthodontic treatment. For example, a sample question from this section was, You had agreed to go on a family picnic on Saturday, but your friend has just called to say that he/she has also planned a picnic outing and would like you to go along. If you could choose, you would? The answer was in a five-point Likert-like format with graded responses.

STATEMENT OF PROBLEM

Discovering what motivates patients and their parents to seek and to cooperate in orthodontic treatment
is complex. The psychologic aspects of motivation in seeking orthodontic care have not been studied extensively. The major focus of research has been on the characteristics associated with cooperative patients and their parents and not to the prediction of patient cooperation.

The questionnaire by EI-Mangoury to identify the patient’s personality traits did not include parental influence, patient’s perception of severity of malocclusion, or the age of the patient. Albino and her colleagues devised the Orthodontic Attitude Survey to determine the desire of both the patient and the parent for orthodontic treatment, but it has not been used to predict patient cooperation. In addition, the effect of a single-parent household has not been reported.

The purpose of this study was to explore the contribution of the following variables for predicting patient cooperation.

2. Psychosocial characteristics of the parent(s).
3. Psychosocial characteristics of the child. Since patient motivation may depend on social desirability, need for approval, and need for achievement for children, these aspects of the personality characteristics of the patient and the parent were an important consideration.
5. Parent’s attitude and opinions about orthodontics.
6. Parent’s perception of the degree to which the child is compromised socially.
7. Child’s perception of the degree to which he/she is compromised socially.
8. Parent(s)/patient’s relationship to the orthodontist.
9. Demographics of the parent(s) and the child.

The Albino group performed a pilot study which evaluated the psychosocial characteristics of both the parent and the child. For the parent, the Social Desirability Scale by Crowne and Marlowe was used, and for the child the Personality Research Form by Jackson was used. These two instruments were used in our study because they showed potential for identifying characteristics consistent with cooperative patients.

METHODS AND MATERIALS

The sample consisted of patients accepted for treatment in the Graduate Orthodontic Clinic. There were 57 girls and 43 boys for a total of 100 patients who filled out the questionnaire. The ages of the patients ranged from 9 to 16 years. Similarly, 131 parents, which included 32 fathers, 97 mothers, and 2 stepparents filled out questionnaires. At the time of consultation and presentation of a treatment plan, each patient and their parent(s) filled out a separate questionnaire. Questions were asked in the following areas:

1. Demographics.
2. Need for approval.
   a. Crowne and Marlowe’s Social Desirability Scale for the parents.
   b. Jackson’s Personality Research Form for child’s need for approval and need for achievement.
3. Orientation toward peers or parents (in child’s questionnaire only). This was derived from the Social Choices Scale by Albino.
4. Attitudes about and desire for orthodontic treatment. This was a revised version of the Orthodontic Attitude Survey devised by Albino and her colleagues.
5. Relationship with the orthodontist. Evaluated by scoring questions pertaining to the parent’s, as well as the patient’s, perception of their relationship to the orthodontist that we developed. This section consisted of three questions for the patient and four questions in the case of parents. We wanted to evaluate if there was a correlation between cooperative behavior and the patient-parent relationship to the orthodontist. In the patient’s questionnaire the questions were as follows:
   1. The orthodontist who is treating me likes me as a person.
      True or False?
   2. The orthodontist is concerned about me and wants to do what is best for me in the long run.
      True or false?
   3. The orthodontist who is treating me likes me...
      (a) more than my parents
      (b) the same as my parents
      (c) less than my parents

In the parent’s questionnaire the questions were as follows:

1. I have confidence in the orthodontist who is treating my child
   Yes or No.
2. I understand how the orthodontist is going to straighten my child’s teeth.
   Yes or No.
3. Check one or more of the following adjectives which describe the orthodontist:
   (a) Outgoing
   (b) Quiet
   (c) Well-adjusted
   (d) Maladjusted
   (e) Unselfish
Table I.

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>Child</th>
<th>Parent</th>
<th>Orthodontist</th>
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<tr>
<td><strong>Original</strong></td>
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<tr>
<td>Demographics</td>
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<td>Need for approval</td>
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<tr>
<td>Marlowe &amp; Crowne's Social Desirability Scale</td>
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<td></td>
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<tr>
<td>Jackson's Personality Research Form Orientation toward peers or parents</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Choices Scale</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orthodontic Attitude Survey</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Relationship with the orthodontist</td>
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<td></td>
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<tr>
<td>Revised orthodontic patient cooperation scale</td>
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<td></td>
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<td><strong>Six-month interval</strong></td>
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<td>X</td>
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<tr>
<td>Revised orthodontic patient cooperation scale</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

(f) Selfish
(g) "Others centered"
(h) Self-centered
(i) Friendly
(j) Unfriendly

4. The orthodontist is concerned about the well-being of my child:
(a) Strongly agree
(b) Agree
(c) Disagree
(d) Strongly disagree

Each graduate student in orthodontics also filled out a questionnaire that was a revised version of the Orthodontic Patient Cooperation Scale devised by Slakter et al. as the dependent variables. Independent variables included from the patient’s questionnaire were age, sex, race, grade, need for achievement, need for affiliation, patient’s relationship to peers, concern for their own dental occlusion and appearance, wish for treatment, positive attitude toward braces, relative value of treatment, and relationship to the orthodontic graduate student.

Table I provides an overview of the questionnaire inventory, as well as who completed the questionnaires at the beginning and later at each 6-month interval. The first set of questionnaires were filled out before starting treatment and then every 6 months for two successive 6-month intervals. The patients, parents, and orthodontic graduate students were asked to fill out follow-up questionnaires. These were used to predict cooperation for each subsequent 6-month period of treatment. For patients and parents, the 6-month follow-up questionnaires were confined to only two sections of the original questionnaire:
1. Attitudes about and desire for orthodontic treatment.
2. Relationships with the graduate student.

The graduate student’s follow-up questionnaire asked about the graduate student’s perceptions about the patients and the motivation of the parents, the parent-child relationship, and finally, whether any changes had occurred in the patient’s cooperation.

Every patient record had a chart to note the following information about completion of each patient appointment: broken appointments, tardiness for appointments, appliance maintenance, broken arch wires/loose bands, oral hygiene, use of functional appliances, use of headgear, and use of elastics. These charts, in addition to the graduate student’s follow-up questionnaire, were used to evaluate the patient’s cooperation during the study. Scoring of the questionnaires was based on valence of the answers; i.e., the scoring was based on a positive or a negative response to the statements. This was because the questions had different answer formats. Some questions had true-false formats, while others had Likert-like formats. If the Likert-like items were scored according to the degree to which the patient or parent agreed or disagreed with the statement, it was believed too much weight would be given to these items as opposed to the true-false items.

Pearson correlation coefficients were calculated with the average score from the patient’s cooperation chart and the score from the modified version of the Orthodontic Patient Cooperation Scale (1980) by Slakter et al. as the dependent variables. Independent variables included from the patient’s questionnaire were age, sex, race, grade, need for achievement, need for affiliation, patient’s relationship to peers, concern for their own dental occlusion and appearance, wish for treatment, positive attitude toward braces, relative value of treatment, and relationship to the orthodontic graduate student.

Independent variables taken from the parent’s questionnaire were whether the family came from a rural, suburban, or urban setting; the marital status of the parent filling out the questionnaire; the occupation, income, and educational level attained by the parents; the ethnic background of the parents; the scores from Crowne and Marlowe’s Social Desirability Scale; the parent’s concern for their child’s dental occlusion; the parent’s wish for their child’s treatment; the parent’s
Table II. Summary of stepwise regression procedure for dependent variable scores from orthodontic patient cooperation scale first 6-month data*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Partial $R^2$</th>
<th>Model $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthodontist's perceived relationship to patient</td>
<td>0.1836</td>
<td>0.1836</td>
</tr>
<tr>
<td>Parent's attitude toward braces</td>
<td>0.0622</td>
<td>0.2458</td>
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<tr>
<td>Patient's wish for treatment</td>
<td>0.0360</td>
<td>0.2818</td>
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<tr>
<td>Importance of occlusion to parent</td>
<td>0.0316</td>
<td>0.3134</td>
</tr>
<tr>
<td>Patient's concern for own occlusion</td>
<td>0.0308</td>
<td>0.3442</td>
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<tr>
<td>Parent's perceived relationship to orthodontist</td>
<td>0.0337</td>
<td>0.3779</td>
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<tr>
<td>Patient's perceived relationship to orthodontist</td>
<td>0.0358</td>
<td>0.4137</td>
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*No other variables met the 0.1500 significance level for entry into the model.

positive attitude toward their children's braces; the relative value of orthodontic treatment; the parent's importance of their child's dental occlusion; and the parent's relationship to the orthodontic graduate student.

Finally, two independent variables were included from the questionnaire that the graduate student completed, namely the student's opinion about their relationship to the patient, and the graduate student's opinion about their relationship to the patient's parent(s).

RESULTS

Among all the correlation coefficients calculated between the average scores of patient cooperation, based on Patient's Cooperation Charts, the four highest correlation coefficients obtained were (1) the patients' sex, which had a low moderate negative correlation of $-0.26$ indicating that the girls were somewhat more cooperative than the boys; (2) whether the child had a positive attitude toward braces had a low moderate negative correlation of $-0.20$; (3) whether the family lived in a rural, urban, or suburban setting had a low moderate negative correlation of $-0.21$ indicating that patients who were from a suburban environment were slightly more cooperative than patients who were from rural settings; and (4) the graduate student's relationship to the patient's parents had a positive correlation of 0.25.

The selected highest correlation coefficients for the Orthodontic Patient Cooperation Scale were (1) the parents' relationship to the graduate student (0.18); (2) the graduate student's relationship to the patient (0.37); and (3) the graduate student's relationship to the parent (0.24). No other variables had correlations as high as these, and in fact, most of the remaining variables had correlations less than 0.1.

A series of stepwise and multiple linear regressions were performed to examine the relationship between the dependent variables: (1) Orthodontic Patient Cooperation Scale and, (2) the averaged scores from the Patient Cooperation Charts and the independent variables previously mentioned. Results showed approximately 40% of the variability in the cooperation scores could be predicted from the variables selected for inclusion by the analyses (Tables II and III). Only those variables significant at the 0.15 level were included in the model.

The correlation coefficients for the second 6-month evaluations are given in Table IV. The highest values noticed were between the scores on the Patient Orthodontic Cooperation Scale and (1) the score on the graduate student's perception of their relationship to the patient (0.65), (2) the graduate student's relationship to the patient's parents (0.33), (3) the parent's concern for the child's dental occlusion (0.30), (4) the patient's opinion about the relative value of orthodontic treatment (0.23), (5) the parents' wish for child's treatment ($-0.23$), and (6) the graduate student's perceived relationship to the patient (0.34).

Multiple linear and stepwise regressions were done with the same dependent and independent variables as were used in calculations for the correlations for the second 6-month data. The results of stepwise regression analysis with Orthodontic Patient Cooperation Scale as the dependent variable are given in Table V. It was found that about 60% of the variability in the responses
Table IV. Selected Pearson correlation coefficients calculated from variables against scores from the orthodontic patient cooperation scale second 6-month data

| Orthodontist's perceived relationship to the patient | 0.64760 |
| Orthodontist's perceived relationship to the parent | 0.33439 |
| Parent's concern for their child's occlusion | 0.30141 |
| Patient's opinion about the relative value of orthodontic treatment | 0.22955 |
| Parent's wish for their child's treatment | -0.22815 |

Table V. Summary of stepwise regression procedure for dependent variable scores from orthodontic patient cooperation scale second 6-month data

<table>
<thead>
<tr>
<th>Partial R²</th>
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<td>Orthodontist's perceived relationship to patient</td>
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<tr>
<td>Parent's concern for child's occlusion</td>
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<td>Patient's concern for own occlusion</td>
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<td>Parent's relative value of treatment</td>
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<td>Importance of occlusion to patient</td>
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<td>Parent's wish for treatment</td>
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<td>Patient's attitude toward braces</td>
<td>0.0031</td>
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</table>

*No other variables met the 0.1500 significance level for entry into the model.

The comparison of the results of the stepwise regression analyses from the data collected after the second 6-month period indicated that 60% of variability that
The findings in this study do not corroborate the findings of EI-Mangoury, who concluded that orthodontic cooperation could be accounted for with the Orthodontic Patient Cooperation Scale compared with 20% of the variability that could be accounted for with the patient’s cooperation charts. This difference could be explained by the fact that the analysis in which the Patient Cooperation Scale was the dependent variable included the graduate orthodontic student’s perceived relationship to the patient that accounted for a major contribution to the regression model (0.42) of the 0.60 total for the regression model.

As seen in Tables II, III, IV, V, and VI, the correlations and proportions of variability accounted for, as a result of the stepwise regression analysis, were so small that no definite conclusions could be drawn from the data collected as far as the consistency in prognosticating patient compliance in orthodontic treatment. The findings in this study do not corroborate the findings of EI-Mangoury, who concluded that orthodontic cooperation was predictable through psychologic testing. Kreit et al. concluded that the poor relationship between the parent and the patient was the most salient factor in those patients being identified as noncooperative. This was not found to be the case in our study.

Other independent variables including age, sex, household income, and single-parent versus two-parent households were investigated and did not yield any significant relationships.

Neither personality tests, the Orthodontic Attitude Survey, nor the patient’s orientation toward peers proved to be significant predictors of patient cooperation, as suggested by Albino et al.

Because of the complex nature of human behavior and subjectivity in the design of the measuring instruments, as well as responses to the questionnaires, it was difficult to predict patient cooperation. One outstanding feature of this investigation was that the doctor-patient relationship had a positive impact on the cooperative behavior of the patients.

Perhaps future investigations in this area should focus more on the doctor-patient relationship, its effect on the progress of treatment, and methods to enhance the relationship if it is perceived as less than desired.

One possible conclusion that can be drawn from this study is that we as doctors may tend to blame the patients quickly rather than ourselves if the course of treatment is not going as desired. If we were to look at ways to improve communication with our patients, we might be able to “salvage” a potentially uncooperative patient.

We express our gratitude to Dr. Paul S. Buck, Ph.D., Assistant Professor, Division of Pediatric Psychology, Department of Psychiatry and Behavioral Sciences, University of Oklahoma Health Sciences Center, Oklahoma City, Okla. for his assistance in developing the method and statistical analyses used in this investigation.

REFERENCES